Nineteenth-century water supply to the city of Lisbon and the Anglo-French "Windsor" Steam Engines

The *Águas Livres* aqueduct, completed in 1799, ensured that water from the *Serra de Sintra* catchment area could reach Lisbon. It is a familiar sight to residents of Lisbon and visitors alike. In the second half of the 19th century, however, it was clear that this water would not continue to be enough to meet the growing population and increased per capita water demands of the capital city. To supply the demand for water at the time, a new aqueduct was built between 1871 and 1880 to transport water collected 114km north of Lisbon from the *Olhos de Água* sources (Santarém) on the Alviela river. On reaching Lisbon the water was stored in a reservoir built within the former Franciscan *Barbadinhos* convent grounds. The problem of how to move the water from the reservoir to the people of Lisbon was solved with the installation of pumps powered by steam engines supplied by a company owned by a British father and son named Windsor. What initially seems strange about this is that the Windsors' factory was in France. However, further investigation shows that, from the middle of the 18th century, numerous British engineering companies had been set up in France, particularly in Normandy, Paris, and the Loire.

By Andrew Shepherd[1,2,3]

Water supply to Lisbon

Construction of the *Águas Livres* aqueduct started in 1731 and was finally finished in 1799. The parts completed before the 1755 earthquake withstood the tremors, having been designed with earthquakes in mind; the previous major earthquake, in 1531, having caused around 30,000 deaths. The water was sourced from *Mãe de Água Velha* in the Belas region northwest of Lisbon in the Sintra hills catchment area, and the route broadly followed that of an old Roman aqueduct. It was funded by a tax (*real da água*) on essential goods such as olive oil, wine, and meat.[4]

The system was composed of a 14 km section from Belas to the *Mãe de Água das Amoreiras* reservoir in Lisbon, which was not fully completed until 1834, as well as several secondary sections to transport water from around 77 sources and five galleries to about 30 fountains in Lisbon. These fountains mainly supplied the city's western half, the area for urban renewal, which was built on limestone, while the older eastern areas such as Alfama, built on clay, continued to rely mainly on local springs and wells, which had been the main source of water for Lisbon before the aqueduct was built. By 1850, a municipal survey revealed that Lisbonites were getting their water from 42 fountains and six public wells. Around 3,000 water carriers, most of Galician origin, filled barrels in public fountains at no cost and went around the city selling it. There was little or no supply directly to households.[5]

[1] The idea for this article came from a talk on Lisbon's Water Supply given by Tiago Nuno Ramos of the *Empresa Pública das Águas Livres* (EPAL) to the Royal British Club at the *Grémio Literário* on 14 May 2024. I am grateful to Mr Ramos for the subsequent assistance he provided by making available information that made this article possible.
[2] My thanks to Tiago Nuno Ramos and Ninna Taylor for reviewing an early draft
[3] In addition to the sources cited below, several of the people mentioned are the subject of Wikipedia articles
[4] Museu da Água (1). Águas Livres Aqueduct. https://www.epal.pt/EPAL/en/menu/water-museum/permanent-collection-and-associated-heritage/%C3%A1guas-livres-aqueduct
[5] Saraiva, Tiago, Luísa Schmidt & João Pato. *Lisbon Water regimes: Politics, Environment, Technology and Capital (1850-2010).* Flux 2014/3-4 (97-98), pp. 60-79. https://www.cairn.info/revue-flux1-2014-3-page-60.htm

The network originating in Sintra was about 58 km long by the mid-19th century. Although the system's waters ceased to be used for human consumption from the 1960s, its dominant feature remains a memorable part of the Lisbon scenery. I refer, of course, to the 35 arches over the Alcântara valley, which cover 941 metres and contain the largest stone arch of its type in the world at 65.29 metres high.[6]

Over time, other reservoirs were added. For example, between 1860 and 1864, a cistern was constructed underneath the *Jardim do Principe Real* to regulate the pressure between the *Mãe de Água* reservoir and the piping system of the city's downtown area. It was designed in 1856 by a French engineer, Louis-Charles Mary. Known as the *Patriarchal* reservoir, its octagonal shape is matched by that of the pond that lies over the cistern at the centre of the garden.[7]

In the mid-19th century, population growth meant that the water supplied by the *Águas Livres* aqueduct was no longer sufficient. Additionally, it had become obvious that the sewerage system needed to be improved as a matter of urgency. As Portugal's first Minister of Public Works, a position established in 1851 by prime minister Antônio Noronha under the first *Regeneração* government, Fontes Pereira de Melo, later to become prime minister, was given the task of achieving this. He calculated that each person defecated 250g of solid waste a day on average, and that this would require 10 litres of water per person a day to wash it down the drains. As such a flow of water was lacking, the solution was to increase the volume of water available. Between 1856 and 1864, the *Empresa das Águas de Lisboa* was founded and, with private ownership, the first water distribution network was finally built in Lisbon.[8]

To meet the demand for water, a new 114km aqueduct, known as the Alviela aqueduct, was built to transport water collected from the *Olhos de Água* sources on the Alviela river. Construction took place between 1871 and 1880. Using the expertise of Louis-Charles Mary, gained during the work to supply Paris with water during the Haussmann era, the technologies employed were revolutionary, including the use of cast-iron pipes, instead of stone ones. This aqueduct sent water to a reservoir with a capacity of 10,952 cubic metres, built within the grounds of an extinct Franciscan convent that had been occupied from 1747 to 1834 by the Italian *Barbadinhos* order (so called because the monks wore beards). The reservoir, which is situated a short walk to the northeast of Santa Apolónia station, was named after the convent.

The Barbadinhos Pumping Station

[6] *ibid*
[7] Museu da Água (2). *Patriarcal Reservoir*. https://www.epal.pt/EPAL/en/menu/water-museum/permanent-collection-and-associated-heritage/patriarcal-reservoir
[8] The *Empresa* became a public company in 1974

Over time, four steam pumping units were constructed to lift 30,000 cubic metres of water a day and pass it through a filtration system before sending it to the city through a network of seven more reservoirs. Three machines were installed in 1877. The first two could lift more than $300m^3$ per hour to a height of 77 metres, taking the flows to the *Penha de França* cistern through a pipe 970 metres long. The third could lift more than $500m^3$ per hour to a height of 44 metres. The fourth machine, to be installed later, in 1889, could lift to both heights.

This *elevatório* had three sections: the coal deposit, the boiler area, and the steam equipment area. The machine room was on the upper floor and housed the four steam machines made by E. Windsor & Fils from Rouen, Normandy (also referred to as *Ateliers Windsor*). On the ground level was the "Pump Room" where the respective pumps were housed. The boilers were in another area, in the so-called "Boiler Room".[9,10]

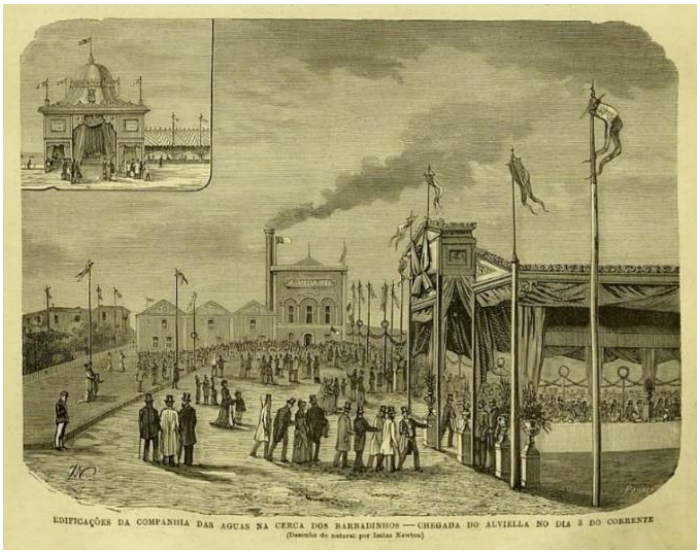
The Steam Engine Room

The *Barbadinhos* Steam Pumping Station was inaugurated on 3 October 1880 in the presence of King Luís I, D. Fernando II, and Infante D. Augusto, members of the government, and representatives of the Lisbon, Belém and Olivais town councils, as well as other dignitaries and the press. It operated until 1928. After that, water pumping was done electronically until the station was closed in 1951. The boilers and the 40m chimney were demolished in the 1950s but the former steam engines and the pumps have been retained. In 1990, the Water Museum was awarded the Council of Europe Museum Prize, essentially for its work in maintaining and preserving the four steam pumping stations, making it, at the time, the only Portuguese museum to have received this honour. In 2010 the pumping station building was classified as a Unit of Public Interest (Ordinance no. 1176/2010 of 14 December). The building now houses the Water Museum's permanent collection, and the Historical Archive of the *Empresa Pública das Águas Livres* (EPAL). Water supplied by EPAL to about three million people in the Lisbon

[9] Museu da Água (3). *Estação Elevatória a Vapor dos Barbadinhos*. https://www.epal.pt/EPAL/menu/museu-da-%C3%A1gua/exposi%C3%A7%C3%A3o-permanente-patrim%C3%B3nio-associado/esta%C3%A7%C3%A3o-elevat%C3%B3ria-a-vapor-dos-barbadinhos

[10] Custódio, Jorge. 2003. *A água industrial: As nascentes do Alviela em Lisboa e a Estação Elevatória dos Barbadinhos a vapor*. https://www.gecorpa.pt/Upload/Revistas/Rev18_Art15.pdf

District and elsewhere now comes from the *Castelo do Bode* reservoir on the River Zêzere and from Valada on the River Tagus, as well as from groundwater sources in Alenquer, Lezírias and Ota.[11,12,13]



The Official Opening on 3 October 1880

Two earlier Windsor steam engines had also been installed in 1868 as part of a water pumping station at the *Largo do Chafariz de Dentro*, designed to pump water to the São Vicente parish from the Praia Reservoir, which had a capacity of 970 m^3 cubic metres. This was the first pumping station in the city for urban water supply, and the Windsors both supplied and assembled the engines. Later, the pumping station would function as a backup system for the *Barbadinhos* station. It was de-activated in July 1938 and the building now contains the *Museu do Fado*.[14,15]

The *Companhia das Aguas de Lisboa* was delighted with the Windsor machines, both the earlier two and the first three supplied for *Barbadinhos* in 1877. On 12 October 1880, engineers J. de Paiva Conceiro and J. Pires de Sonsa Gomez, on behalf of the company, wrote to Windsor to express their appreciation for the equipment supplied:

> *We certify that Windsor et Fils of Rouen, France supplied our company with two 25-horsepower lifting steam engines using the two-cylinder vertical pendulum condensing system. During acceptance tests carried out on these machines on 19 June 1869 it was found that the average consumption of fuel was 1.18 kilograms per horsepower-hour in water lifted. After entering into operation, these machines have always operated correctly to the entire satisfaction of the company, without the necessity of any repairs or any maintenance costs being incurred.*
>
> *Since the delivery of the above machines the company has again entrusted to these excellent manufacturers an important new order for three similar machines but with each having 120 horsepower, measured by the water lifted, to be used to pump the water from the*

[11] *ibid*
[12] Museu da Água (4). *Water Quality*. https://www.epal.pt/EPAL/en/menu/our-water/campaigns/water-quality#:~:text=EPAL%20supplies%20water%20to%20around,of%20quality%20water%20to%20all.
[13] https://restosdecoleccao.blogspot.com/2015/01/estacao-elevatoria-dos-barbadinhos.html
[14] SIPA. *Central Elevatória da Praia / Museu do Fado e da Guitarra Portuguesa.* http://www.monumentos.gov.pt/site/app_pagesuser/SitePageContents.aspx?id=08a335ea-db85-4fdd-862b-fe6e623e44a8
[15] Custódio

Alviella (sic) for distribution to the city of Lisbon. These magnificent machines have been in operation for several months and, on the basis of our experience, we can say that they meet all points covered by the guarantee regarding performance and consumption that were imposed on the constructors by the specifications. We have noted that the consumption of coal is less than the figures guaranteed.

All other specifications in the contract have been fully met. In addition to their excellent economic performance, the machines offer all the desirable reliability. This is combined with great elegance and the perfect attention to all details of construction. In summary, we conclude that Windsor et Fils have completely fulfilled all aspects of its contract with the Companhia das Aguas.[16]

So impressed was the *Companhia das Aguas* with the engines supplied by Windsor that it purchased a fourth one in 1889, this one having 155hp. This was the 487th engine supplied by the company; the three earlier machines in Barbadinhos having been numbers 349-351. By 1898, 14,000 houses had been connected to the Lisbon water supply and fire hydrants had been established, greatly reducing fire damage in the city.[17] So, what was the company that impressed Lisbon's water company, and why was a British-owned company manufacturing steam engines in France?

British industrialists in France

The 1760s saw the beginning of the industrial revolution in Britain. Many of the first technologies were for application in the textile industry, such as the spinning jenny developed by James Hargreaves between 1765 and 1770, the spinning frame and water frame developed by Richard Arkwright in 1767-1769, Samuel Crompton's mule (1774-79) and Edmund Cartwright's power loom of 1789.

British engineers had been in France since the 1720s, working in industries such as watchmaking, foundries, and glass making.[18] One of the earliest inventors, John Kay, who developed the flying shuttle, made his way to France in 1747 and by 1754 had been given permission to open some small factories there to produce the shuttle. Kay had left England because he could not benefit from his patents as the textile manufacturers formed a cartel to indulge in patent piracy and it was costing him more to sue them than he stood to gain. Following negotiations with the French government he was awarded an annual fee and a pension and arranged for three of his sons to join him to make the equipment.[19]

Another early manufacturer to move to France was John Holker. Born in Stretford, Lancashire, he had set up a calendering business in Manchester. When Bonnie Prince Charlie's army entered the city in 1746, Holker purchased a commission in the Jacobite regiment that was raised. Captured at Carlisle and sentenced to death he was held in Newgate Prison, in London. After escaping, he made his way to France where he joined a Jacobite regiment in the French army. He came to the attention of Daniel-Charles Trudaine, head of the French bureau of commerce and effectively France's chief engineer, who was known for his maps of France's roads. He believed that Holker would be able to improve the French cotton industry, which was based in Rouen in Normandy, and provided funds to allow him to set up

[16] ARCH'EXPO. *Machine à Vapeur Compound Construite par M. E. Windsor (Ingénieur-Constructeur Anglais à Rouen), Planche Extraite de la « Revue Industrielle », Réalisée Lors de L'exposition Universelle de 1889.* http://www.archexpo.fr/timelinr/machine-a-vapeur-compound-construite-par-m-e-windsor-ingenieur-constructeur-anglais-a-rouen-planche-extraite-de-la-revue-industrielle-realisee-lors-de-lexposition-universe/

[17] Custódio

[18] Chassagne, Serge. *Les Anglais-en France, et plus particulièrement en Normandie, dans la «révolution industrielle » (1715-1880).* Études Normandes 2013. 62-2 pp. 121-140. https://www.persee.fr/doc/etnor_0014-2158_2013_num_62_2_1904

[19] Becchia, Alain. *Quand les mécaniciens anglais équipaient l'industrie textile d'Elbeuf et de Louviers.* Études Normandes, 2017 3-4-1 pp. 28-33. https://www.persee.fr/doc/etnor_0014-2158_2017_num_3_1_3569

two factories: one for spinning and weaving, importing the first spinning jennies into France, and the other for finishing, particularly by calendering. The first known example of jean fabric came from a Holker factory. Holker also established a factory for vitriol (sulphuric acid), which was used to bleach linen. Prior to this Britain had monopolized bleach production. In 1755 Holker was awarded the title of *Inspecteur general des manufactures á l'instar de l'étranger et des ouvriers d'étrangers* (General inspector of foreign factories and foreign workers) by Louis XV.[20]

After these pioneers, numerous other British engineers went to France.[21,22] Some, particularly ordinary workers, were actively recruited by the French government and were invariably Catholic.[23] Manufacturers of textiles included John Theakston and John Flint, former employees of Arkwright, together with James Douglas and George Garnett. Particularly notable was William Cockerill who succeeded in establishing himself first in Verviers and then in Liège, where he set up a machine factory with his three sons. He received the *Légion d'honneur* from Napoleon in 1807. The Napoleonic blockade, which effectively put a stop to British exports to Europe, made Cockerill into a very rich man. Aaron Manby, who had a patent for an "oscillating engine" designed for use in ships or canal boats, established a factory in Charenton-le-Pont in the southeastern suburbs of Paris in 1819, making himself unpopular with manufacturers back in England. Together with Daniel Wilson he also established a company in 1822 to provide hydrogen gas lighting in Paris.[24,25]

It is perhaps strange that the Napoleonic Wars seem to have had little effect on the British industrial businesses in France, in part, perhaps, because they were supplying items required for the French war effort and also because the expertise of the British engineers was not yet matched by their French counterparts. Records of foreigners in France at the time indicate relatively few departures back to Great Britain.[26] After the Congress of Vienna, which followed the overthrow of Napoleon, Britain banned the export of textile manufacturing equipment. This ban was to last until 1843, providing a strong incentive for manufacturers of such equipment in France.

France also attracted people with skills in metallurgy. Foundries were established in the Loire valley to take advantage of the iron deposits and the forests and coal mines that offered fuel. One of the most successful of these, Michael Alcock, was asked by the French government in 1771 to study the work of Matthew Boulton and its application to the supply of drinking water. Boulton was an inventor and business partner of the Scottish engineer James Watt, who had been responsible for numerous improvements to the steam engine. In the final quarter of the 18th century, the partnership installed hundreds of engines in both Britain and overseas, which effectively made possible the mechanisation of factories and mills.[27] However, towards the end of the 18th century there was an increasing demand for high-pressure steam engines, which could be made much smaller for the same output than the engines of Watt, and could run at higher speeds. Watt tried to enforce patents to resist these new engines, but with little success. Arthur Woolf, a Cornishman, is credited with developing the high-pressure compound engine, for which he received a patent in 1804,[28] and the "Woolf" steam engine was, from

[20] *ibid*
[21] For a full discussion of this topic see Vidalenc, J. *Quelques remarques sur le rôle des Anglais dans la Révolution industrielle en France, particulièrement en Normandie, de 1750 à 1850.* Annales de Normandie. 1958 8-2.pp. 273-290. https://www.persee.fr/doc/annor_0003-4134_1958_num_8_2_4379
[22] Chassagne
[23] *ibid*
[24] Samson, Dominique, 2023. *Anglais à Rouen au XIXe siècle.* https://www.association-patrimoines.fr/Anglais-a-Rouen-au-XIXe-siecle.html
[25] Vidalenc
[26] *ibid*
[27] *ibid*
[28] Becchia

the first quarter of the 19th century, among its other uses, the type of machine used almost everywhere when municipalities wanted to raise water from a lower level to a higher level.[29]

Steam engine manufacture in France

Britain was dominating steam-engine manufacture and there was little or no production in France, forcing the textile industry there to buy from the British. The first high-pressure steam machines to be installed in Normandy, and probably in France, were supplied in 1817 by the company of John Davis Hall of Dartford.[30] Hall had worked with the celebrated inventor and mining engineer, Richard Trevithick and, in fact, Trevithick had died from pneumonia while visiting Hall in Dartford. As new steam engines began to arrive in France, so did British engineers to install and maintain them and some of their surnames are still to be found in Normandy. In 1826 in Elbeuf, just south of Rouen, more than half of the steam engines had been imported from Britain and others had been assembled from British parts. British machines were more expensive and took longer to supply and install, but this was apparently a price worth paying as they were less likely to explode. It was not long before Hall, having visited Rouen and noticed a lack of domestic manufacture, established a factory there to make steam engines, together with two of his employees, Thomas Powell and Evan Samuel Scott. The aim was to supply French textile mills and other factories that had previously relied on water power and were no longer able to compete with steam-powered British manufacturers.

The Windsors

Among the arrivals was Edwin Nicholas Windsor who was born in Southampton in 1810, the youngest of five sons. The exact date of his arrival is unknown but it must have been in early 1837 or before as his son, Edwin Wells Windsor, was born in Petit Quevilly on the left bank of the Seine in Rouen, on 27 March 1837. By 1843 the Hall, Powell and Scott partnership had ended, with the latter two deciding to set up their own factories, and Windsor became a director of Hall's company, probably running it together with one of his younger brothers, George, on behalf of John Hall who was still involved with his Dartford company. In 1853 Windsor purchased the company, which at the time was producing both steam engines and boilers, and a year later Edwin Wells Windsor married Charlotte, daughter of Hall, so cementing the family relationship.[31,32,33,34]

In 1860, when the company had around 70 employees, Edwin Nicholas Windsor went into partnership with his son. A decade later they decided to concentrate solely on steam engines, water lifting equipment, transmission systems and hydraulic motors, selling the boiler department to a French company in Rouen. In approximately 1885, Edwin Wells became the head of the company, by which time it had 150 employees. He changed its name from *Windsor & Fils* to *EW Windsor, Constructeur Mecanicien, Rouen.* Edwin Nicholas, who died in Greenwich in 1900, was awarded the *Légion d'honneur.* At the time of the inauguration of the system in Lisbon, Edwin Wells was received by King Luís and made a Knight of the Royal Military Order of Our Lord Jesus Christ.[35,36]

Edwin Wells made investments in machine tools, which enabled the company to better compete with imports from Britain and to diversify into other equipment, such as hydraulic engines and sugar mills. But it was the company's improvements to and manufacture of the high-pressure, two-cylinder

[29] Custódio
[30] His company still exists as J & E Hall, a leading supplier of refrigeration equipment.
[31] Geneanet (1). https://www.geni.com/people/Edwin-Nicholas-Windsor/5009034268580047994
[32] Becchia
[33] Geneanet (2). https://gw.geneanet.org/garric?lang=fr&n=windsor&oc=0&p=edwin
[34] Chassagne
[35] Becchia
[36] ARCH'EXPO

compound “Woolf” engine that had made its name and enabled it to start exporting, including to Portugal.

Windsor Steam Engines in the Barbadinhos Pumping Station

Among the major contracts carried out by the Windsors were: one for the neighbouring towns of Roubaix and Tourcoing, for which the company was said, in 1877, to have acquitted itself in a *manière la plus remarquable*, and for which it was awarded a premium of 5000 Francs on at least two occasions for exceeding the contracted economic performance; provision of a steam engine and pump for the town of Angers in 1866; five water elevators for Rouen, Elbeuf and Arcachon between 1880 and 1884; a similar system in Cherbourg, for which a premium was also paid; seven machines for tobacco factories around 1887; two steam machines for the Reims water service in 1873 and 1880; and two elevator systems in Dieppe to lift water by 82 metres. In addition to the sale to Lisbon, the company also exported to Spain, Germany, Turkey, and South American countries.[37]

While the equipment they supplied was usually well received, it was not always plain sailing. The Briare Canal, which connects the Rhone-Saône and Seine valleys, and which, by the mid-18th century, had 500 barges operating on it just to transport wine, suffered from periodic droughts. The Windsors were given a contract to instal four steam engines to operate the pumps necessary to lift water to the canal’s highest point but the Department of Roads and Bridges reported that the flow of water did not correspond to the specifications guaranteed in the contract. Edwin Nicholas redid all the calculations and found nothing wrong with them. In the end, the Department had to admit that it was their calculations that were wrong. The problem was initially solved by running the pumps for extra hours each day and then an additional engine was supplied. The system installed is now regarded as one of the Windsor company’s finest achievements.[38,39]

At the 1889 Paris Universal Exhibition, the company exhibited three steam machines with a total of 620 horsepower, including one that produced 420 horsepower. The company was awarded a gold medal. The respect that it earned in France was not just for its production of excellent equipment but also because the Windsors never employed foreign workers.[40]

[37] ARCH’EXPO
[38] ARCH’EXPO
[39] Alexandre, Alan and Michel Croguennec. *Histoires d'usines.* L'echo Des Vagues. 2013. isbn 2918616184
[40] ARCH’EXPO

Edwin Wells Windsor died in Rouen in 1906. He had become a municipal councillor in Rouen as well as the President of the Commercial Court.[41] Company ownership passed on to two of his sons, Edwin John (born 1874) and Alfred Georges (born 1878). Both were taken prisoner during WWI and management was taken over by the third son, Henry Charles, who, despite also being mobilized, was seconded to work at the factory in order to produce ammunition. By this time the business had only 48 workers. It continued to function until WWII, but a failure to adapt to changes brought about by the internal combustion engine then led to its closure.[42]

Edwin Wells Windsor and his wife did not become naturalised French citizens until the 1890s. Thus, a case can be made that the suppliers of steam engines to Lisbon's water system were British rather than French. Putting petty nationalistic differences aside, however, the family's story of people from one country thriving in the environment of another can no doubt be well-appreciated by many of the British in Portugal today.

Sources

In addition to those cited, I received information from EPAL that was derived from the following sources:

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- Les journaux des délibérations, maintenant cotés B 1 - 57, figurent dans cet inventaire sous les cotes A 39 bis, A 40 bis, A 41-55. Index dactylographié des personnes, lieux et matières, par P. Jubert (1942), 1366 p., microfilmé aux Archives départementales sous la cote 1 Mi 182.

- Archives anciennes, « Chartrier », registres : État sommaire provisoire, 96 p. A la Bibliothèque municipale de Rouen. Microfilm aux Archives départementales : 1 Mi 181.

- Archives anciennes, « Chartrier », liasses : Inventaire analytique manuscrit (XIXe siècle), 5 vol. de 2206 p. au total. A la Bibliothèque municipale de Rouen. Microfilm aux Archives départementales : 1 Mi 156, 159, 174, 178 et 180. Pour les vol. 1 à 4 : index manuscrit des personnes, lieux et matières (microfilm aux Arch. dép. : 1 Mi 179). Pour le volume 5 : index incorporé à l'inventaire.

- Elbeuf : Archives anciennes : Inventaire sommaire des archives antérieures à 1790, polycopié (s.d. (1984), XVIII-77 p. Reproduction, par M. Sanchez, après mise à jour et nouvelle cotation, d'un inventaire analytique manuscrit du XIXe siècle. Glossaire et index des personnes et matières.

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[41] Geneanet (2)
[42] Alexandre and Croguennec